

Exercises

Device Data

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FHIR and Device-sourced Information

Health care devices can provide a wealth of information that enables a wide range of application capabilities. Using FHIR makes it all that much easier! Two categories of devices will be utilized in these exercises:

Personal Health Devices (PHD) As the name implies, these are devices that are mostly used in home-care contexts, and include “Continua certified” devices advanced by the HIMSS / PCHAlliance.

Point-of-Care Devices (PoCD) These devices are mostly used in acute care / hospital contexts including physiological monitors, infusion pumps and ventilators. They are often more complex and intended to be used by professional clinicians.

NOTE: Both PHD and PoCD devices will be available to generate real-time measurements.

The exercises below (*one set for PoCD and one for PHD devices*) will support a simple Postnatal Preeclampsia (P3E) use case, where a mother who has just given birth is being monitored for preeclampsia (high blood pressure), first at home and then, after an abnormally high reading, back in the hospital for follow-up care. Thus both PHD and PoCD data sources are utilized around a common patient and use case.

Point-of-care Device (PoCD) Hands-on Exercises

The following FHIR resources will be utilized:

Device, DeviceComponent, DeviceMetric, Patient, Observation & Location.

NOTE: Resource validation using draft profiles and Implementation Guide specifications will be a stretch goal!

IF YOU ARE BRINGING OR SIMULATING A PoCD:

1. Create a basic set of PoCD device content on the server
 - Associated with the right patient
 - Including device identification and configuration information
2. Update “observation” readings to the server
3. Update the device location on the server
4. Validate FHIR resources using the draft PoCD IG

IF YOU ARE RETRIEVING PoCD INFORMATION FROM A SERVER:

1. Identify the devices associated with a patient
 - Differentiate between PoCD, PHD and non-device sourced Observations
2. Retrieve the observations from a patient-connected device:
 - Latest readings
 - Readings over a time period (“trended”)
3. Trigger a high Blood Pressure reading to generate an event and notify the patient & caregiver
4. Retrieve device (non-patient) information:
 - Identification and configuration information
 - Location information
5. Validate FHIR resources using the draft PoCD IG

Personal Health Device (PHD) Hands-on Exercises

During the hands-on session of the Device Data tutorial we will explore working with Continua certified medical devices such as blood pressure monitor. As discussed during the tutorial, we will practice using HL7 FHIR resources to model observations that can be received from a Continua Personal Health Device (PHD), and how to securely upload and retrieve the observations to and from an Health and Fitness Service (H&FS). Three FHIR resource types will be used:

1. Patient resource: Demographic and administrative information about the patient.
2. DeviceComponent resource: Characteristics, operational status and capabilities for a component of a healthcare device.
3. Observation resource: Measurements or assertions about a subject. Can be a patient or a device

A few assumptions are made and include the following:

- the use of a resource owner access has already been granted in an OAuth exchange,
- the PHG is using Capability Exchange,
- the upload is taking place between a FHIR Observation Client and FHIR Observation Server, and
- the DeviceComponent is assumed as complete

The following exercises are progressive, and each step builds on the previous steps, so you should try them out in sequence:

Ex.1 Upload Continua Compliant Device Data:

1. Configure PHG with a given Logical ID for the Patient Resource provided by HF&S
2. Receive measurement from Continua PHD
3. Generate FHIR Patient resource(s)
4. Confirm HF&S received PHG

Ex. 2 Analyze Continua Compliant Device Data:

1. Identify and retrieve PHD data for a given Patient Resource
2. Combine patient device data with lab data
3. Notify / alert clinician of high blood pressure reading is detected

Ex.1 Upload Continua Compliant Device Data:

1. Configure PHG

The H&FS is configured with a Patient Resource, generating a FHIR Logical ID. Core resource definitions (i.e. try to resolve <http://hl7.org/fhir/StructureDefinition/Patient>)

The PHG is loaded with the FHIR Logical ID for the Patient Resource created on the H&FS, the H&FS URLs, the client id, the resource owner id, and the password.

The PHG performs Capability Exchange with the H&FS to discover the H&FS FHIR upload capabilities.

2. Receive measurement from Continua PHD (IEEE or Bluetooth device)

- An observation is taken on the health sensor; the sensor communicates the measurement to the PHG. The PHG receives the measurement and associates the measurement with a patient to obtain the Patient Record Logical ID.

*Assumption: The PHG already has been granted a valid access token (in the form of a bearer token) and does not need to request to the OAuth authorization server's token.

3. Generate FHIR Patient resource

- The PHG creates the necessary FHIR resources from the received sensor measurement and internal PHG data.
- The created FHIR resources are uploaded to the FHIR resource server URL obtained from the Capability Exchange Process.

4. Confirm HF&S received PHG

- H&FS validates the authorization using the bearer token, and if access is granted stores the FHIR resources in the context identified by the Patient Resource Logical ID.
- H&FS server returns the appropriate HTTP response.

Ex.2 Analyze Continua Compliant Device Data:

1. Identify and retrieve PHD data for a given Patient Resource

```
GET [base]/?_type=Observation?code=150020
```

2. Combine patient device data with lab data

3. Notify / alert clinician if high blood pressure reading is detected

Blood Pressure (Compound Nu-Observed Value) Sample

```
code.  
  coding  
    system "urn:iso:std:iso:11073:10101"  
    code 150020  
    display MDC_PRESS_BLD_NONINV:non-invasive blood pressure  
effectiveDateTime "2017-02-13T05:42:58:657-05:00"  
component.  
  code.  
    coding.  
      system "urn:iso:std:iso:11073:10101"  
      code 150021  
      display MDC_PRESS_BLD_NONINV_SYS:systolic blood pressure  
valueQuantity.  
  value 105  
  units "mmHg"  
  system "urn:iso:std:iso:11073:10101"  
  code 266016  
component.  
  code.  
    coding.  
      system "urn:iso:std:iso:11073:10101"  
      code 150022  
      display MDC_PRESS_BLD_NONINV_DIA:diastolic blood pressure  
valueQuantity.  
  value 70  
  units "mmHg"  
  system "urn:iso:std:iso:11073:10101"  
  code 266016  
component.  
  code.  
    coding.  
      system "urn:iso:std:iso:11073:10101"  
      code 150023  
      display MDC_PRESS_BLD_NONINV_MEAN:mean blood pressure  
valueQuantity.  
  value 81.7  
  units "mmHg"  
  system "urn:iso:std:iso:11073:10101"  
  code 266016
```